

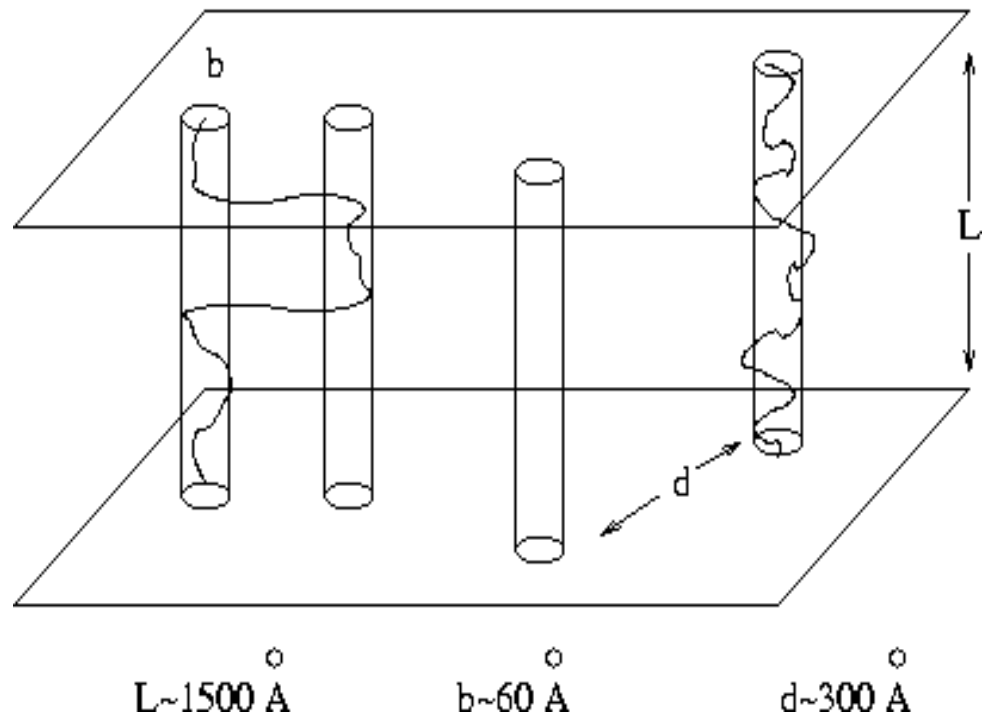
Magnetic Flux Line Motion in High Temperature Superconductors with Extended Defects

U. C. Tauber, Virginia Tech, NSF grant DMR-0075725

The great promise of high-temperature superconducting materials is their capability of carrying current with zero resistance. Possible applications include powerful magnets, e.g., for medical imaging purposes, and efficient power transmission cables.

In these type-II superconductors, however, an external magnetic field enters the sample in the form of quantized magnetic flux lines. When driven by an external current, these flux lines move through the sample, generating Ohmic resistance. Point defects are generally not sufficient to hold those flexible flux lines in place at the desired elevated temperatures.

One solution has been to introduce artificial *extended* material defects, as shown in this picture. We study flux line pinning and transport in such systems by means of Monte Carlo simulations.



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- Our results demonstrate that a periodic array of columnar defects impedes flux line motion markedly better than equally strong but randomly placed linear or point defects. Fig. 2 depicts the current-voltage characteristics for samples with these three types of defects.

- Moreover, we find striking defect signatures in the voltage noise spectrum, e.g., the “narrow-band” peaks shown in Fig.3 for a periodic columnar pin array. Such features can be used as diagnostic tools to identify and characterize the pinning centers in these important superconducting materials.

Students involved in this project:

- Tom Bullard, Ph.D. graduate student
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Fig 2.

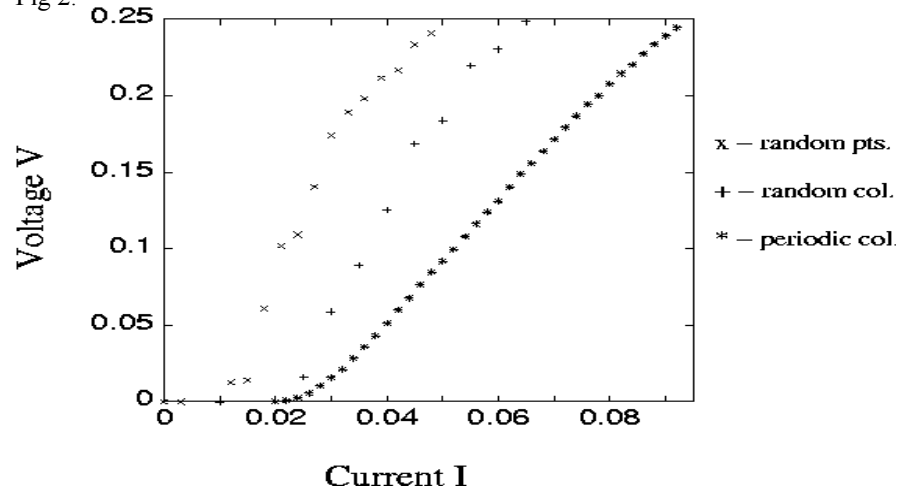


Fig 3

